GreenPlan-IT: Supporting RAA in the Bay Area

Lester McKee, Jing Wu, Pete Kauhanen, Jennifer Hunt, and Tony Hale

San Francisco Estuary Institute

Integrating Reasonable Assurance Analysis and Stormwater/Green Infrastructure Plans

Water Board, Room 1 (2nd floor) September 23, 9am – 4 pm

GreenPlan-IT Funding and Team

Prop 84 State Board Funding

San Francisco Estuary Partnership (SFEP)

- ❑ Jennifer Krebs
- ❑ Josh Bradt

Watearth

- ❑ Jennifer Walker

City Partners

- ❑ San Mateo
- ❑ San Jose

San Francisco Estuary Institute (SFEI)

- ❑ Jing Wu
- ❑ Pete Kauhanen
- ❑ Jen Hunt
- ❑ Lester McKee
- ❑ Dave Senn
- ❑ Tony Hale

Technical advisors

- ❑Matt Fabry
- ❑Jill Bicknell
- ❑Peter Schultze-Allen
- ❑Dino Marshalonis
- ❑Keith Lichten

GreenPlan-IT Answers Key Questions

- Where could green infrastructure be used to reduce flows and pollutant loads?
- What are the most cost-effective locations?
- What flow and load reductions could we expect to see over decades as green infrastructure is implemented?

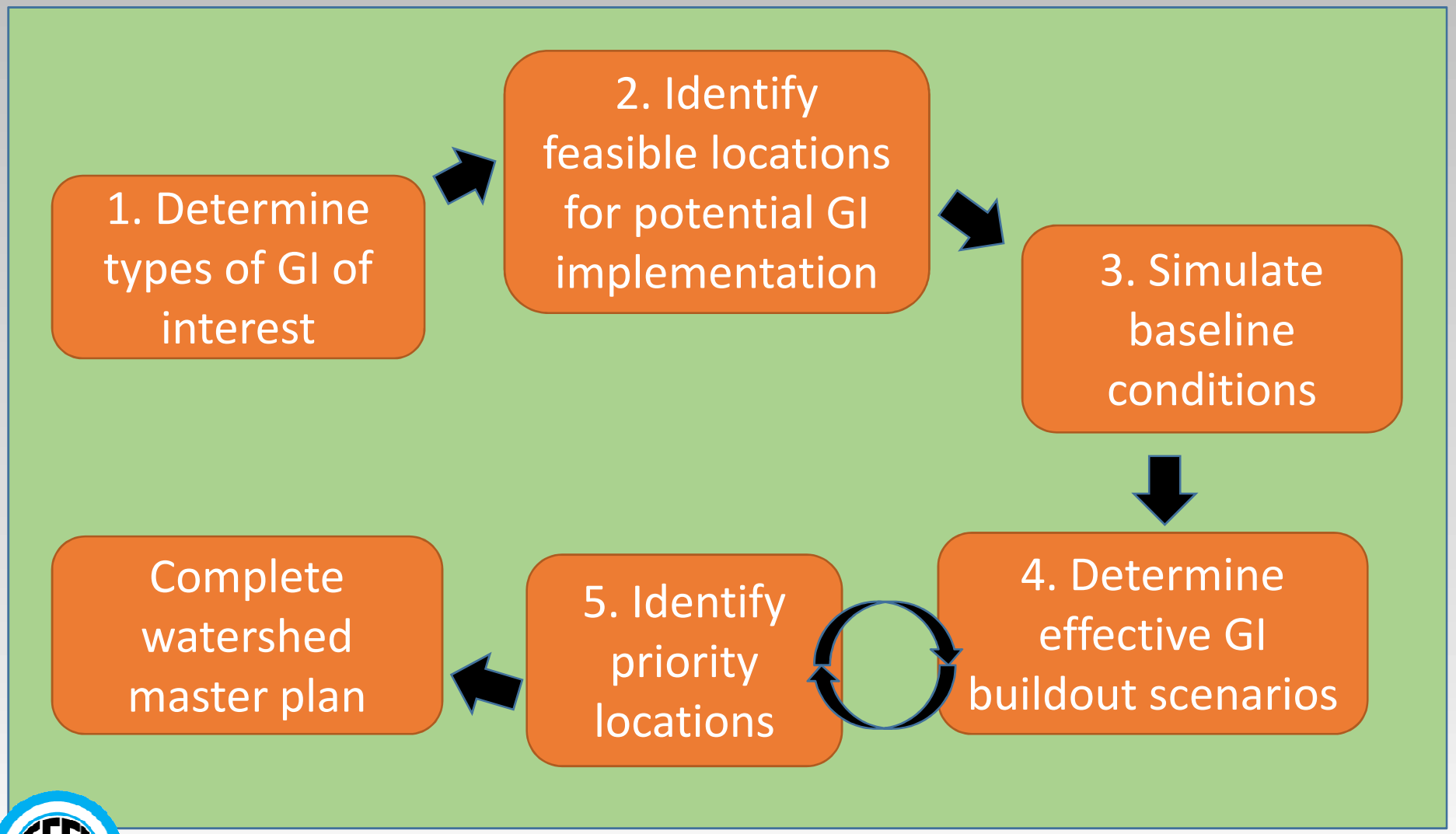
So why choose GreenPlan-IT?

- GreenPlan-IT is **flexible in three key ways**:
  - ✓ It comes packaged with regional Bay Area base layers
  - ✓ The tool is modular
  - ✓ It is spatially flexible

- GreenPlan-IT is rigorous but can and will evolve
  - ✓ Science advisors
  - ✓ Decades of combined experience

- **GreenPlan-IT is free for download and use.**
  - ✓ Consultants and line staff can deploy the tool on their own (without SFEI!)

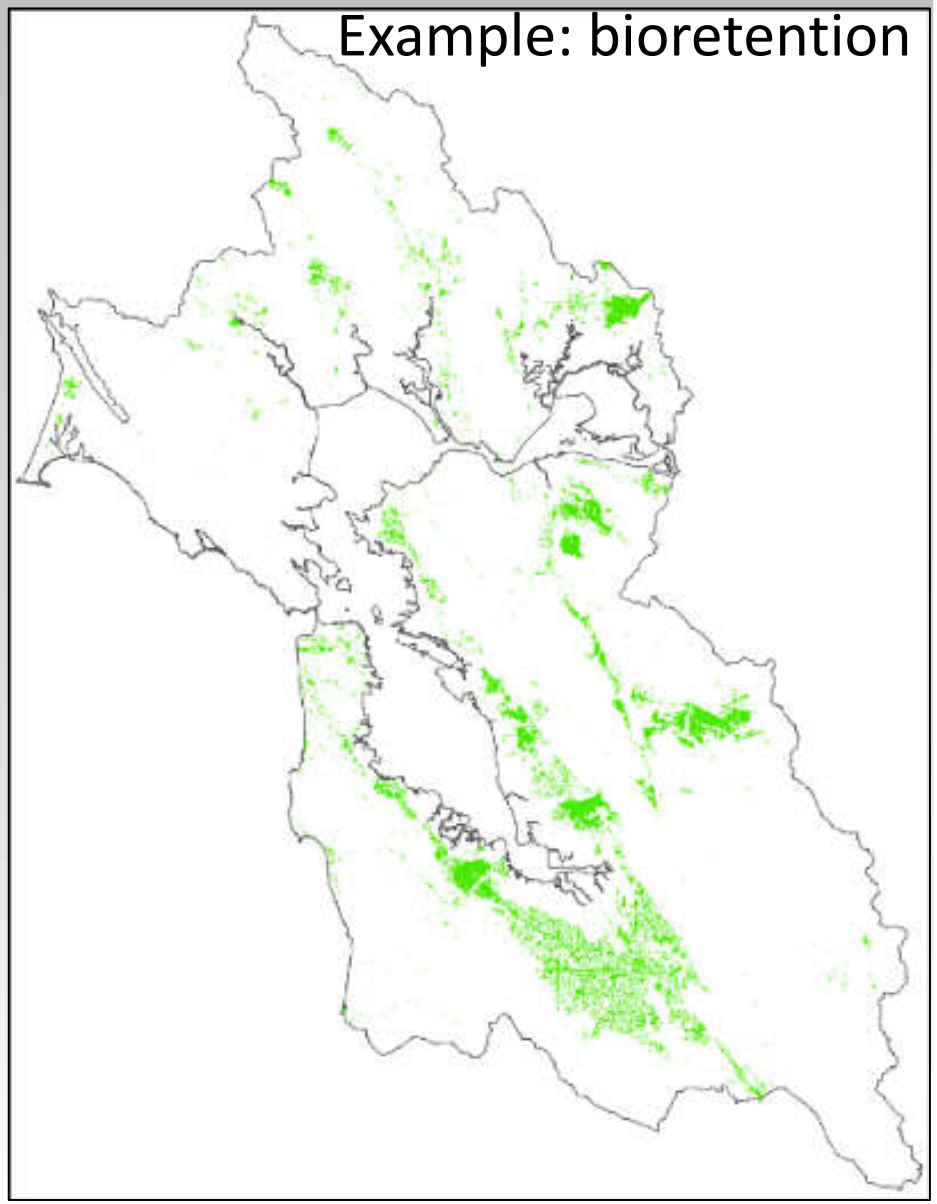
Five Easy Steps!



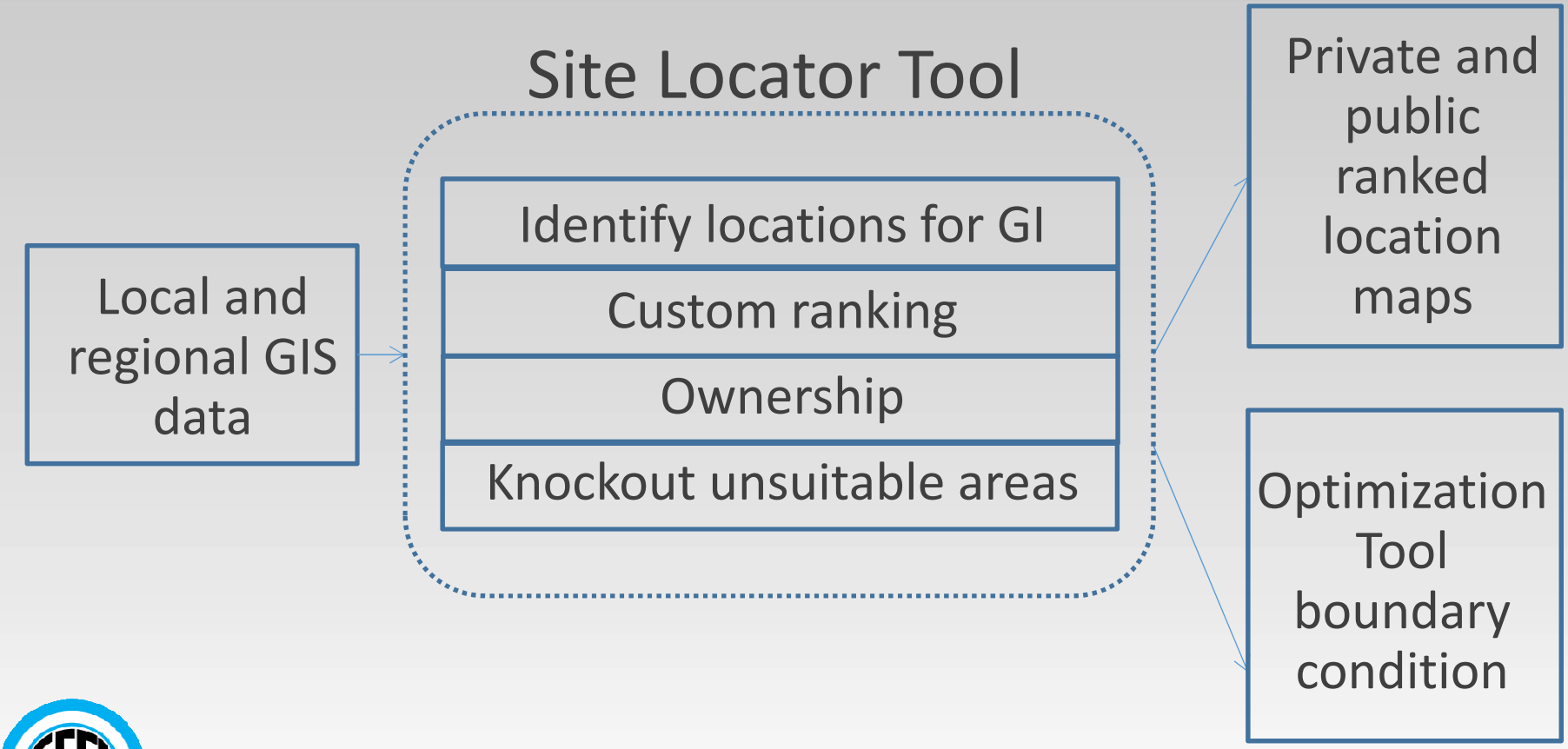
Step 1: Determine types of Green Infrastructure of Interest

- Infiltration Trench
- Bioretention
- Permeable Pavement

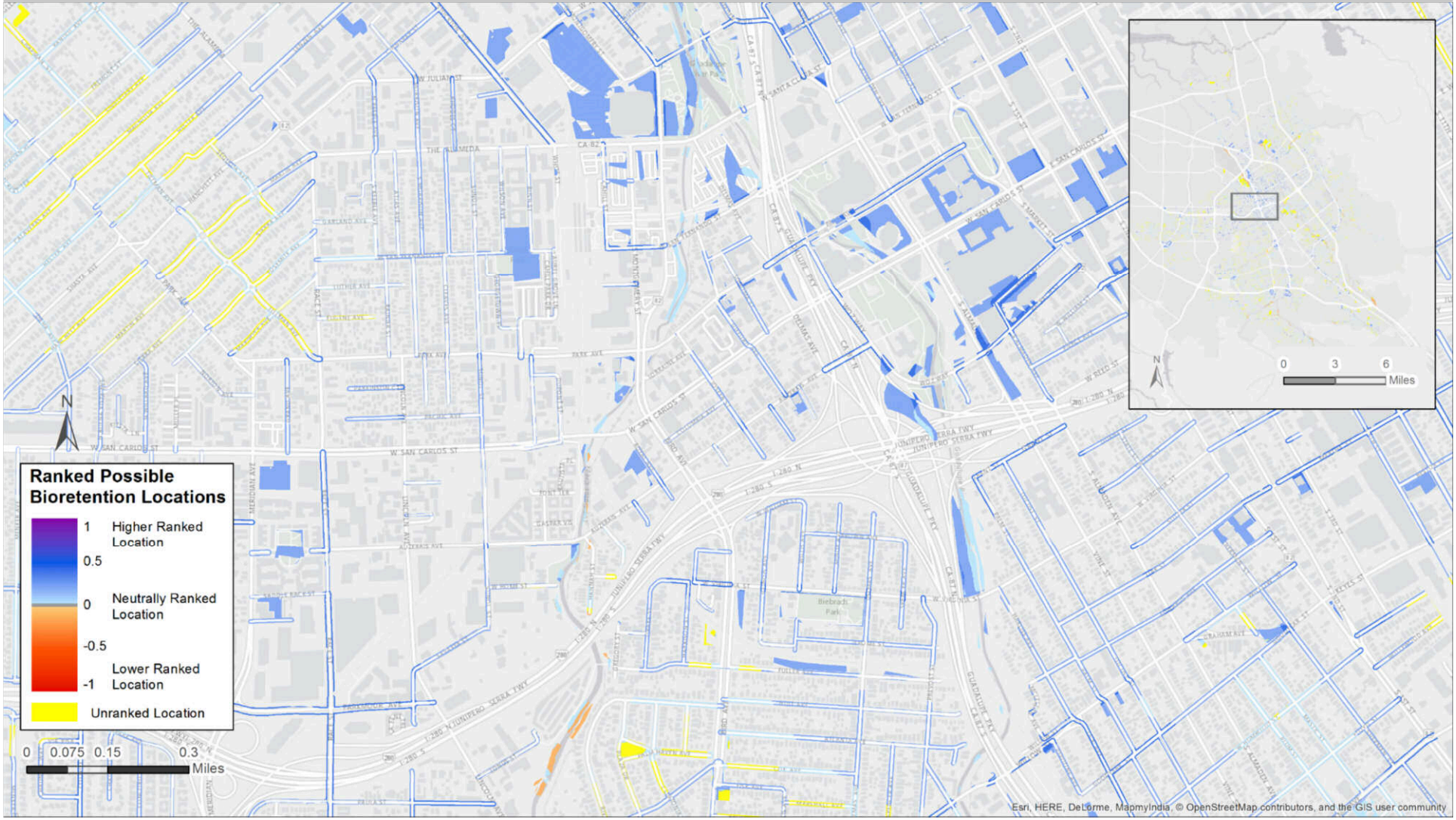
- Vegetated Swale
- Storm Water Wetland
- Wet Pond



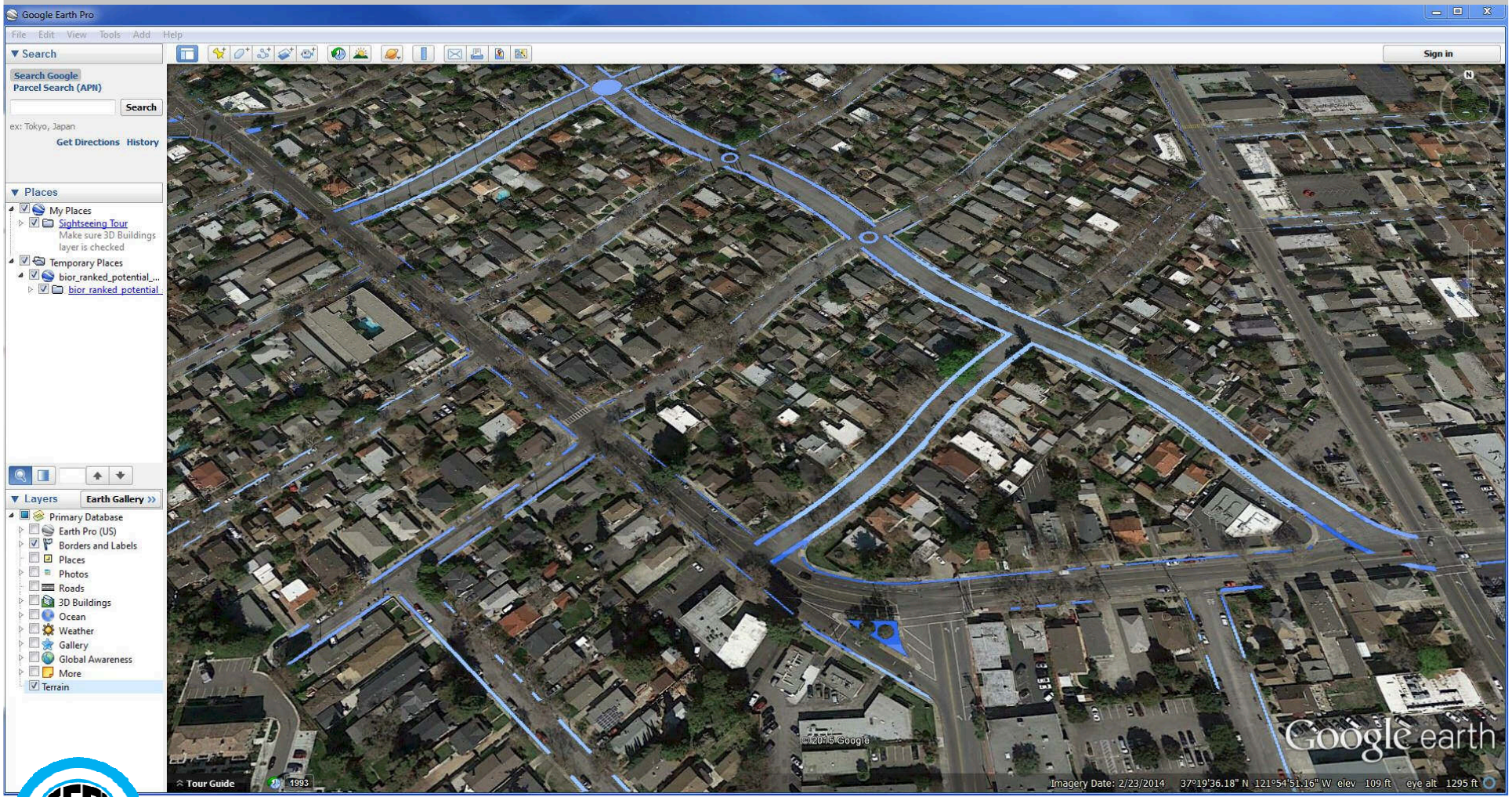
Step 2: Identify feasible locations for potential GI implementation



Outputs = Maps and Tables

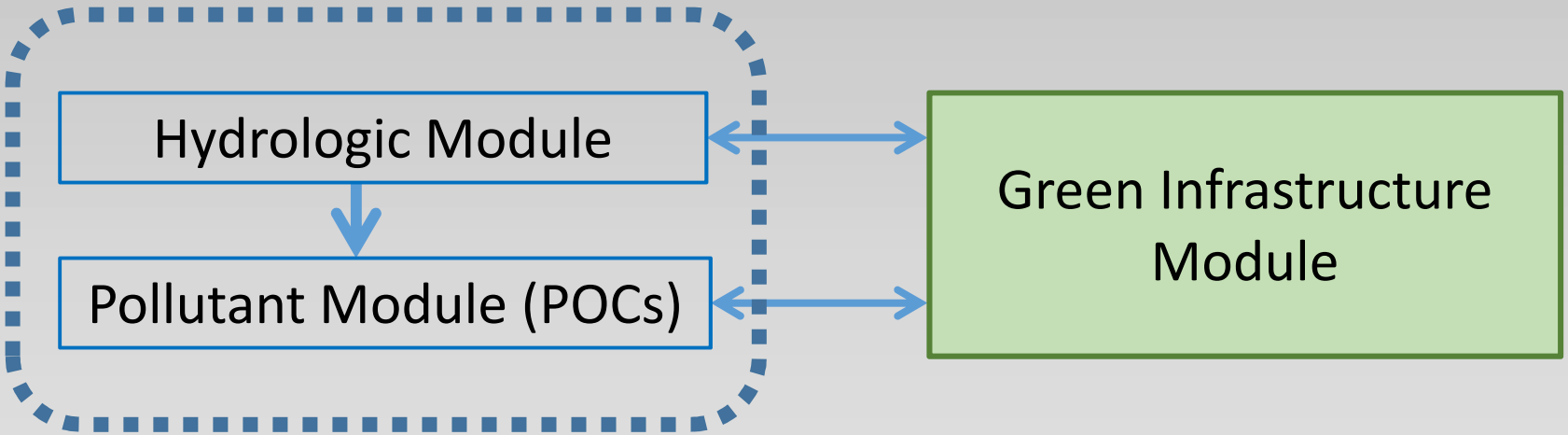


Viewable in Google Earth



Step 3: Model Current Condition

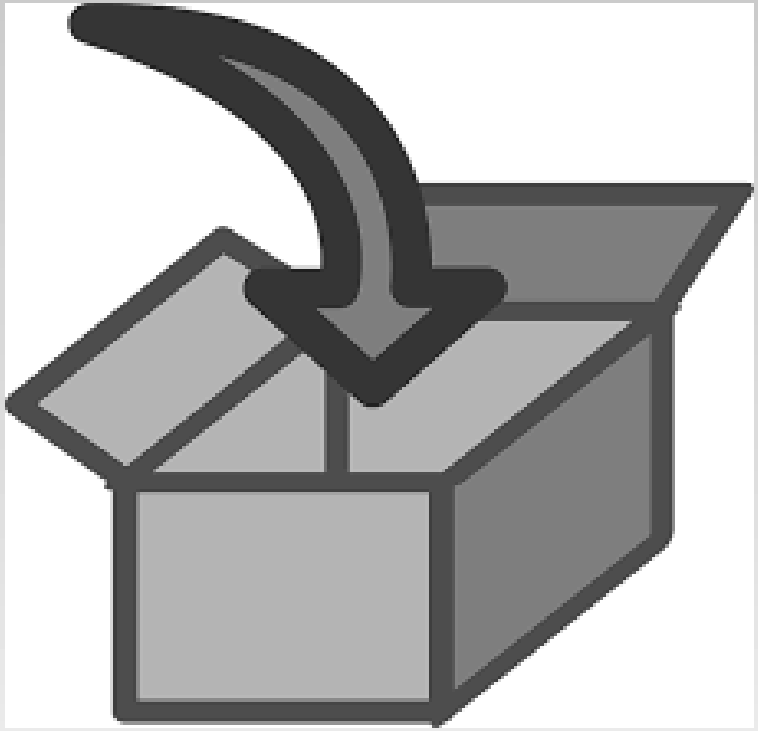
- EPA's SWMM model



- Establish baseline condition
- Identify critical pollutant source areas
- Quantify flow reduction from various GI scenarios

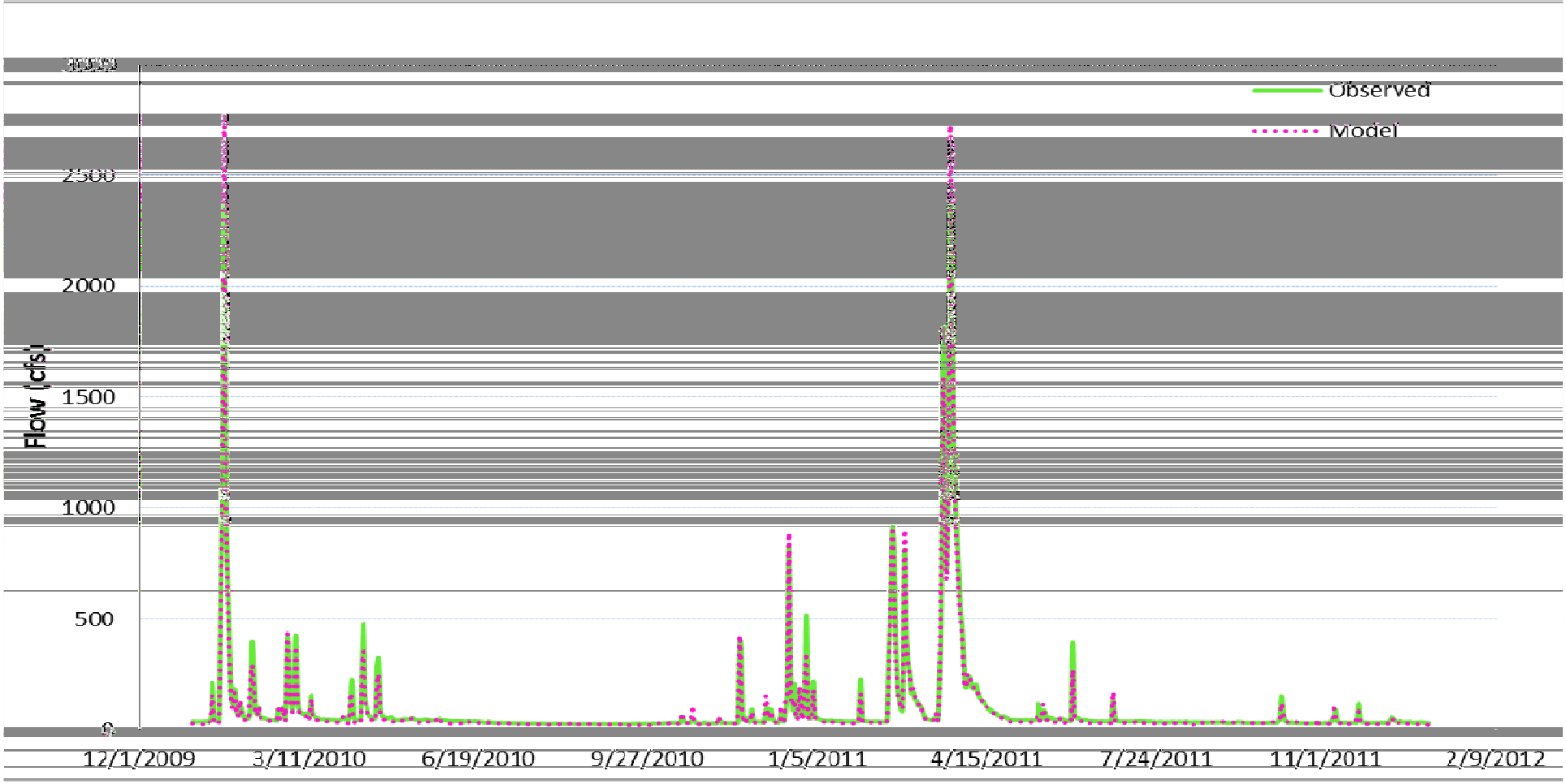
What goes into the Model?

- ❑ Watershed characteristics
- ❑ Meteorological data
- ❑ Boundary condition
- ❑ Calibration Data



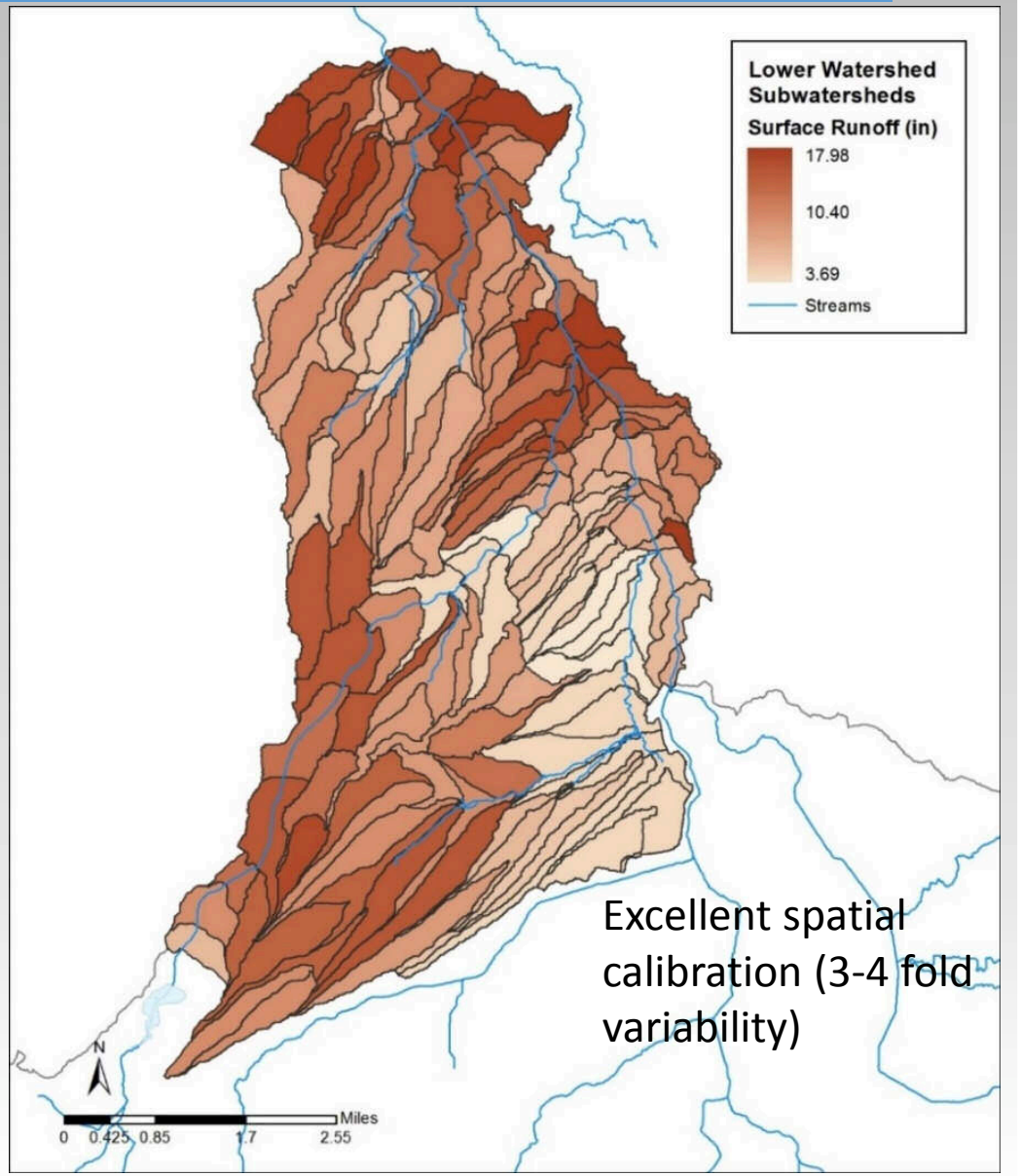
Model Calibration for Guadalupe River at Hwy 101 in San Jose

- Excellent calibration for both flow timing and magnitude



What comes out of the model?

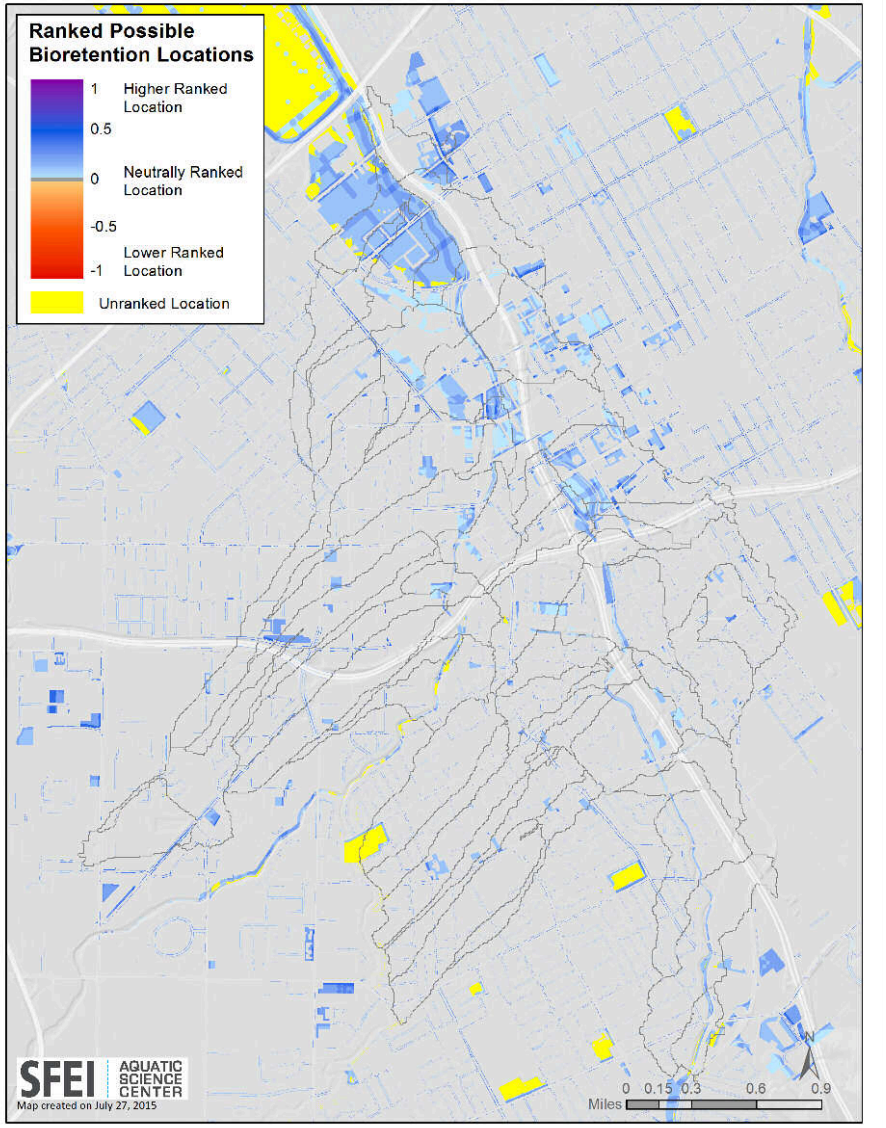
- ID critical runoff & pollutant source areas
- Set stage for Green Infrastructure cost-performance optimization
- Ready for Reasonable Assurance Analysis



Excellent spatial calibration (3-4 fold variability)

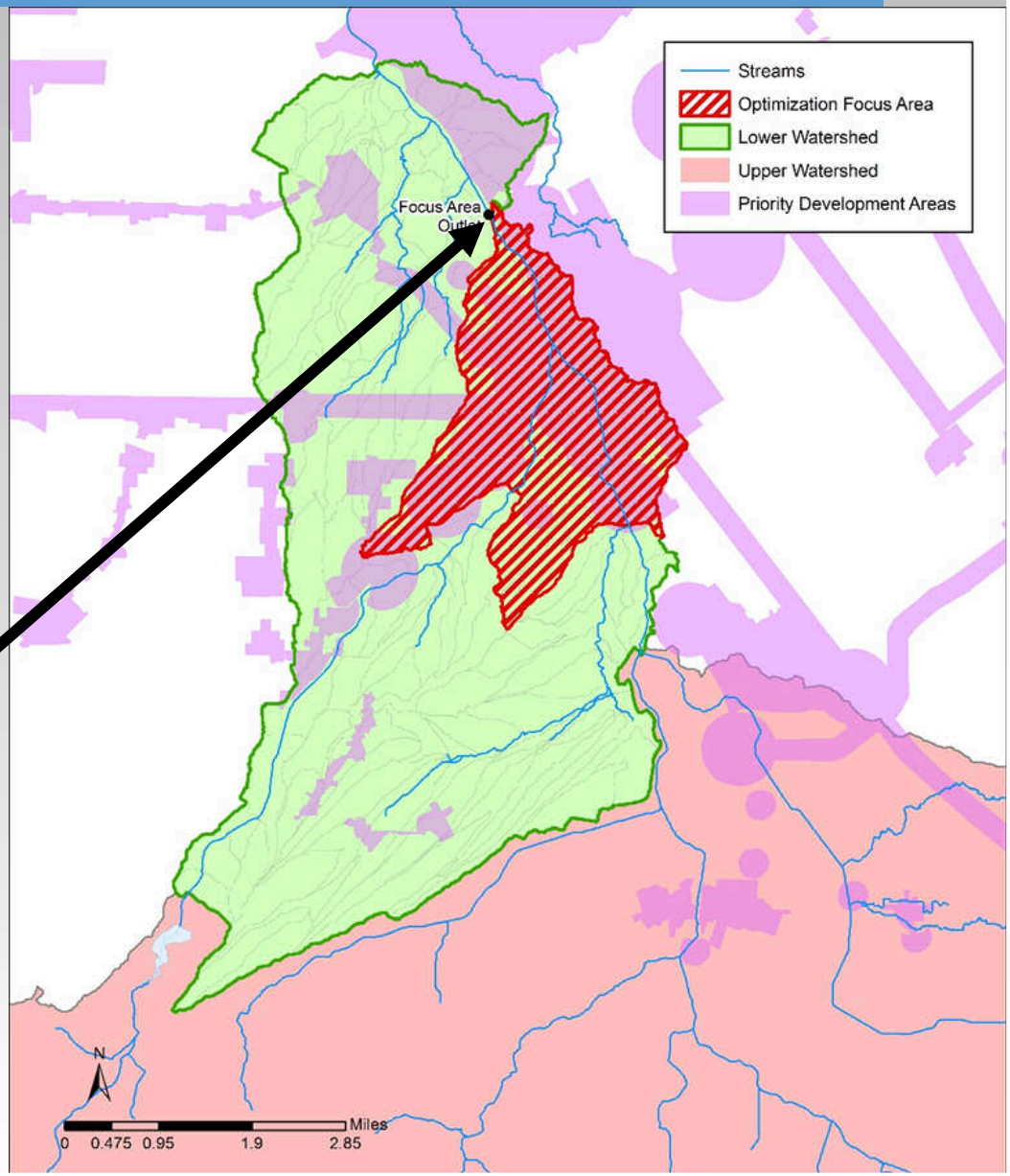
Step 4: Determine optimal Green Infrastructure Solutions

- Thousands of Possible Sites….
- But what are the most cost-effective Green Infrastructure combinations?
- …and at what price?



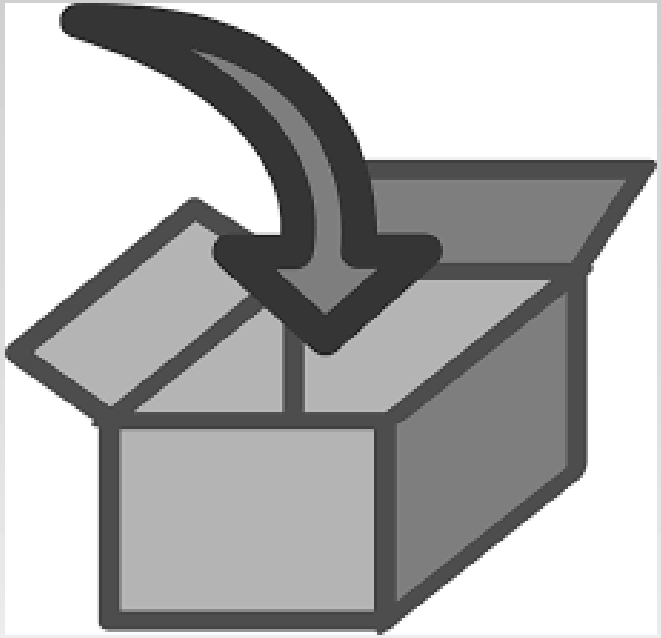
Optimization Focus Area

- Management target
  - Total runoff volume
  - pollutant load
- Assessment point
  - Outlet of focus area

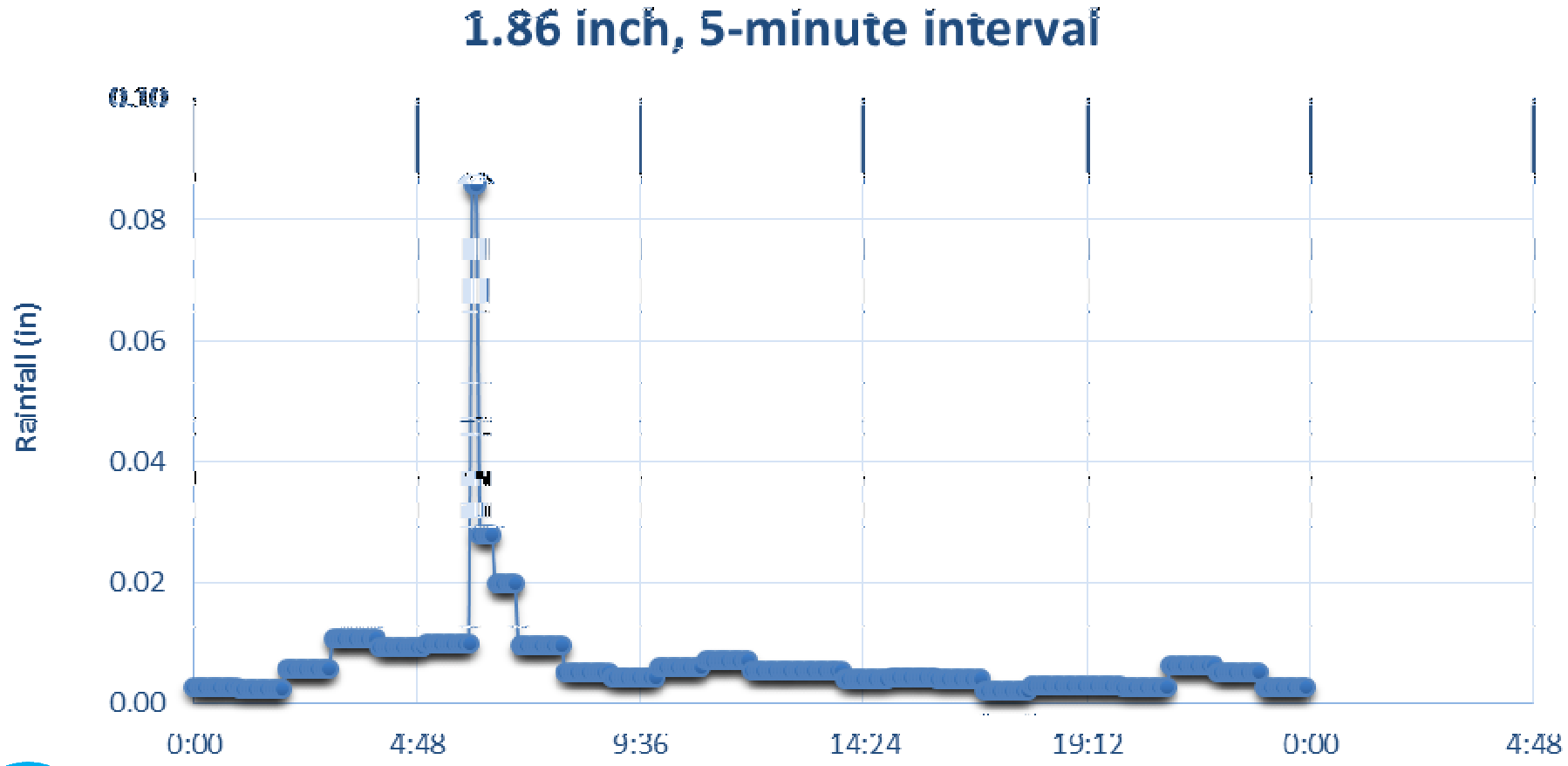


What goes into the Optimization Tool?

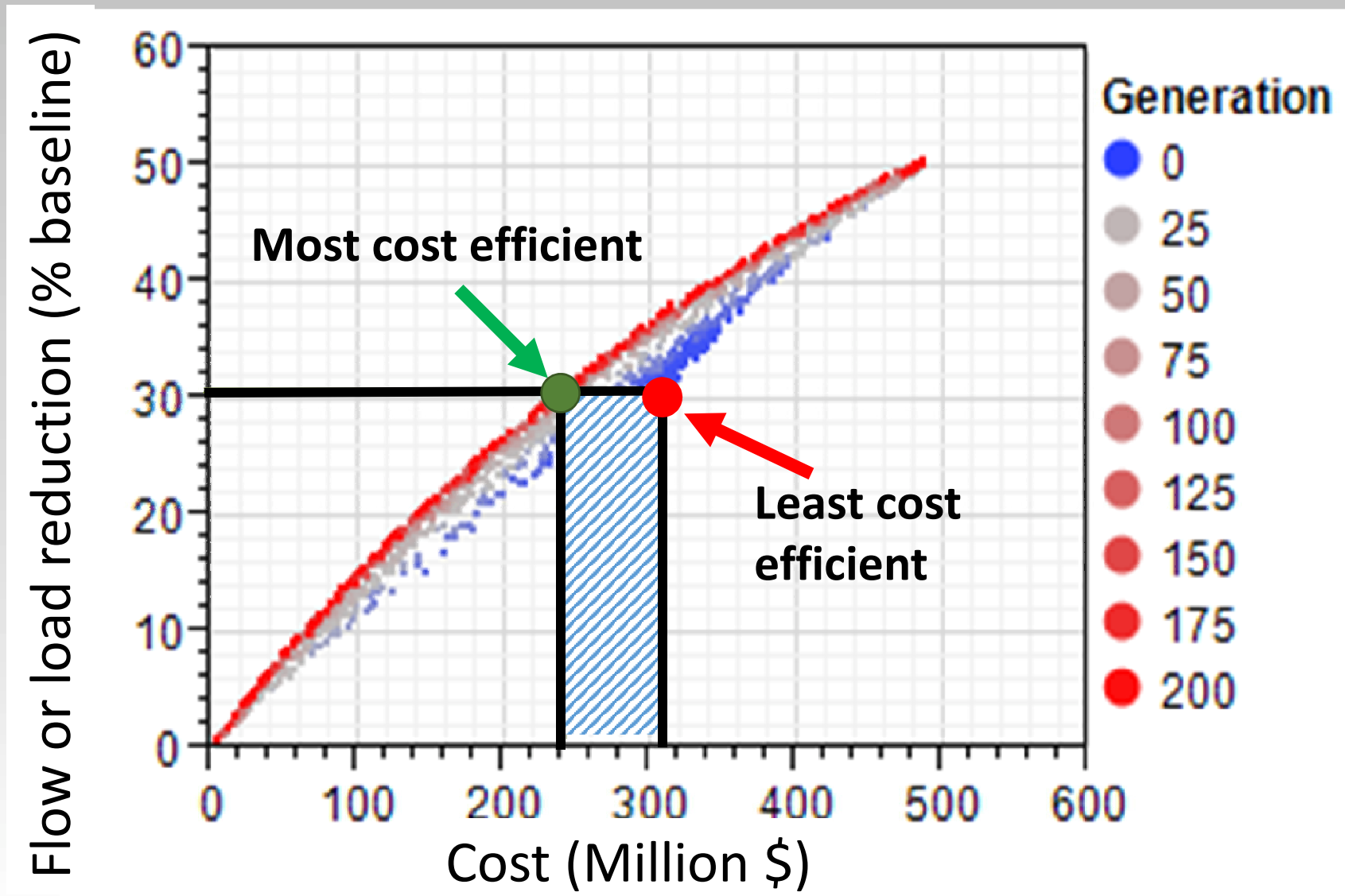
- ✓ Green Infrastructure Attributes
  - ❑ Green Infrastructure area
  - ❑ Soil porosity
  - ❑ Water filtration rate etc.
- ✓ Green Infrastructure Costs
  - ❑ Design
  - ❑ Construction
  - ❑ Operation & Maintenance

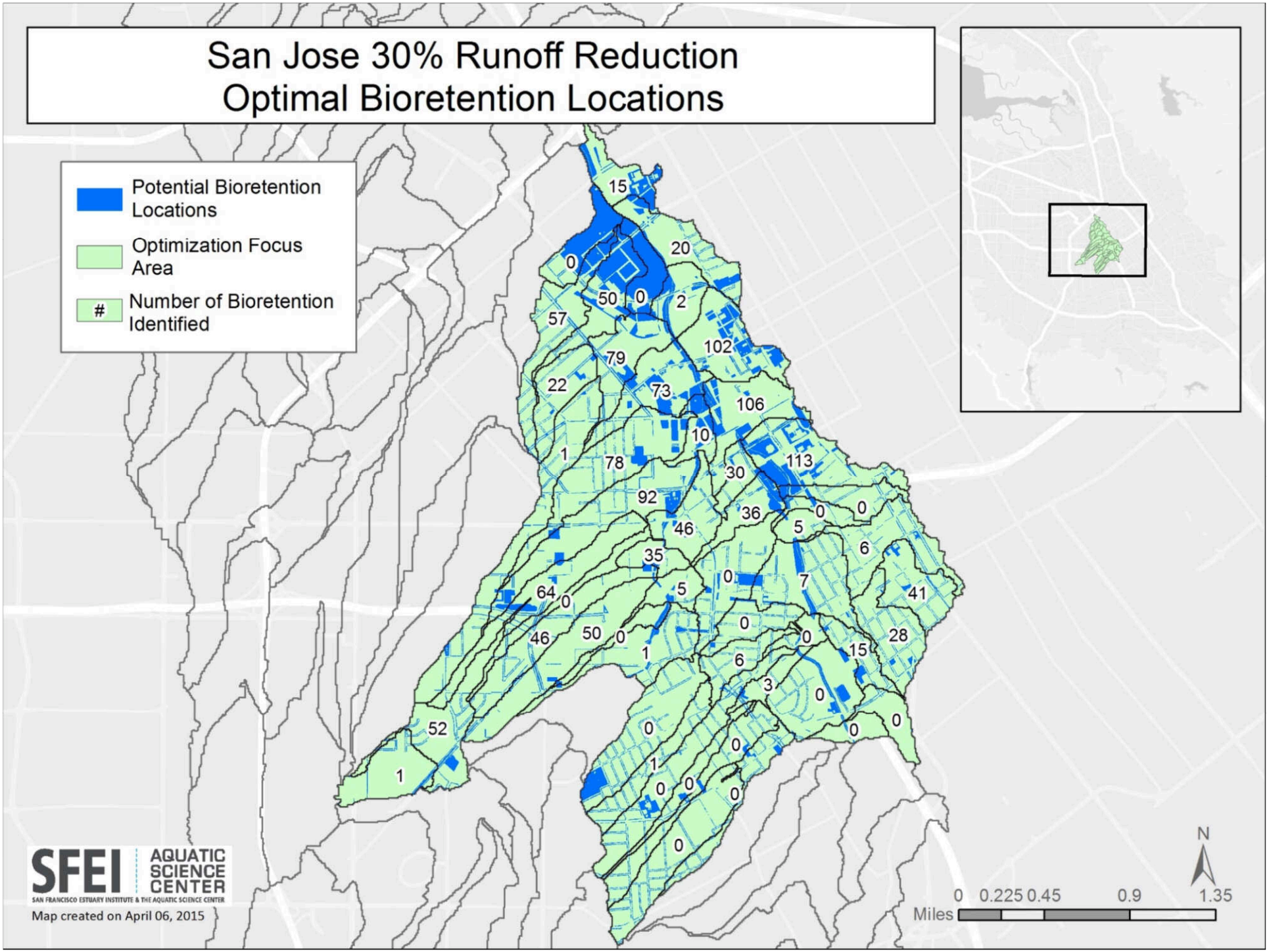


Model the Design Storm
2 year - 24 hour



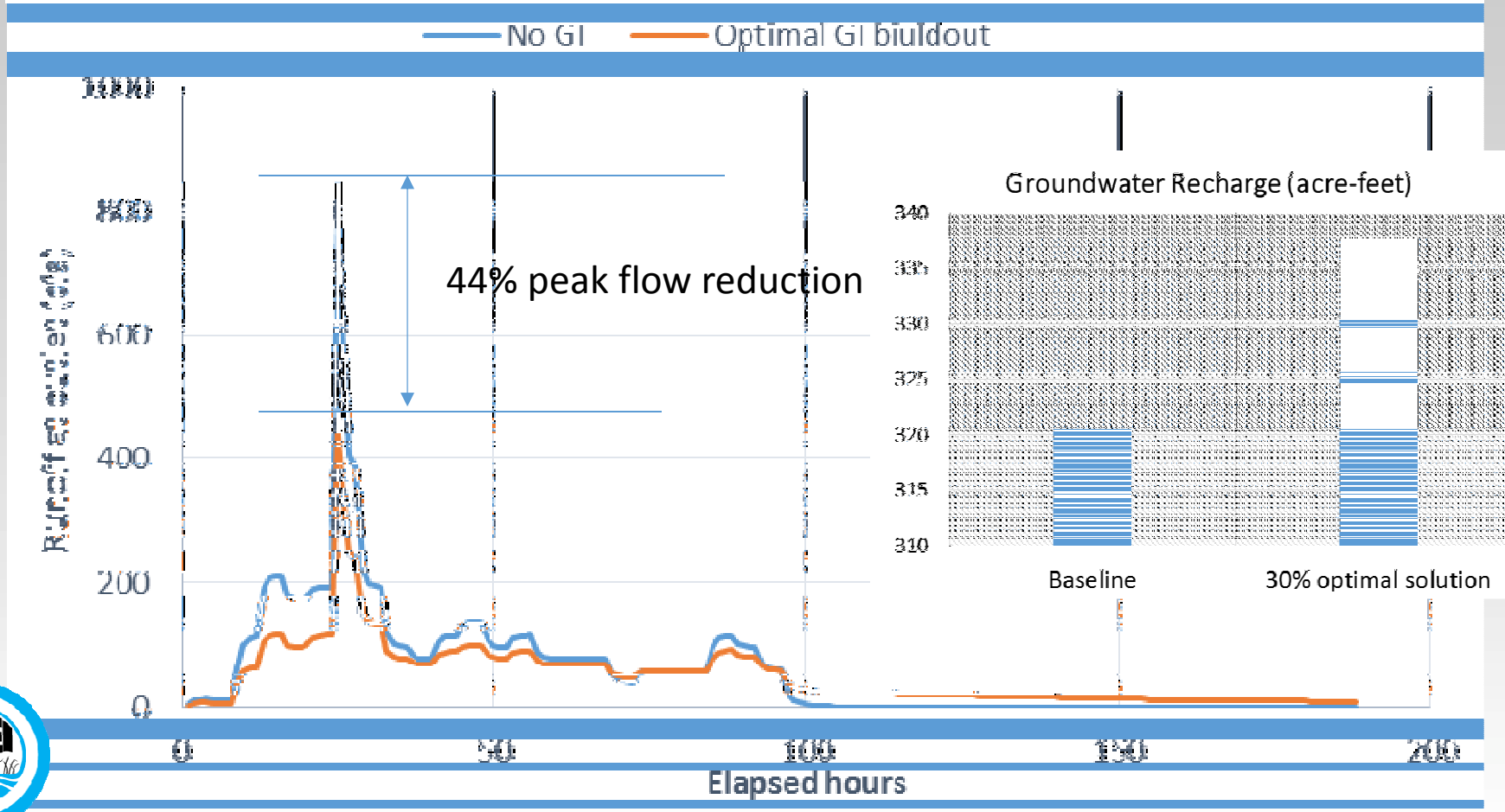
What is the relative cost to implement Green Infrastructure?




San Jose 30% Runoff Reduction
Optimal Bioretention Locations
Potential Bioretention Locations
Optimization Focus Area
Number of Bioretention Identified
15
20
0
50
0
2
57
102
79
22
73
106
10
1
78
113
30
92
36
0
0
46
5
6
35
0
7
64
0
5
41
0
46
50
0
1
0
0
28
15
6
3
0
52
0
0
1
0
0
0
0
0
0
SFEI
AQUATIC SCIENCE CENTER
SAN FRANCISCO ESTUARY INSTITUTE & THE AQUATIC SCIENCE CENTER
Map created on April 06, 2015
N
0 0.225 0.45 0.9 1.35
Miles

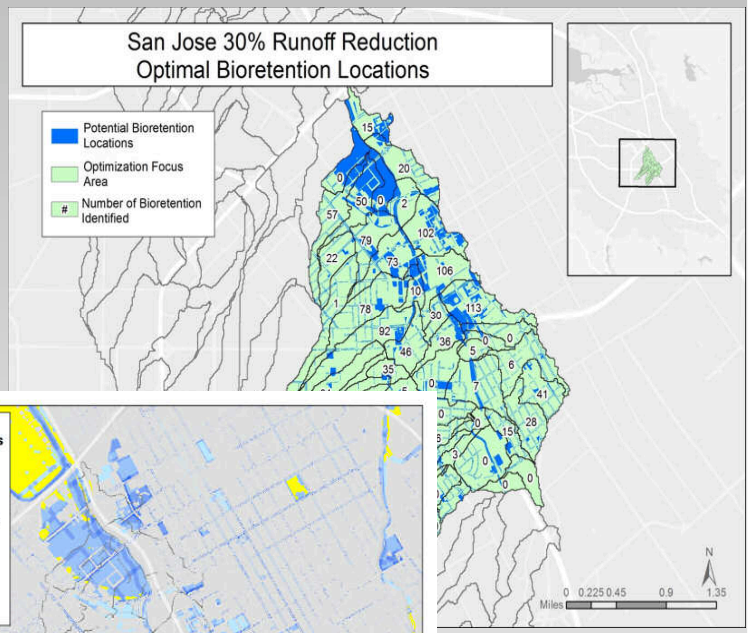
Programmatic Outcomes!

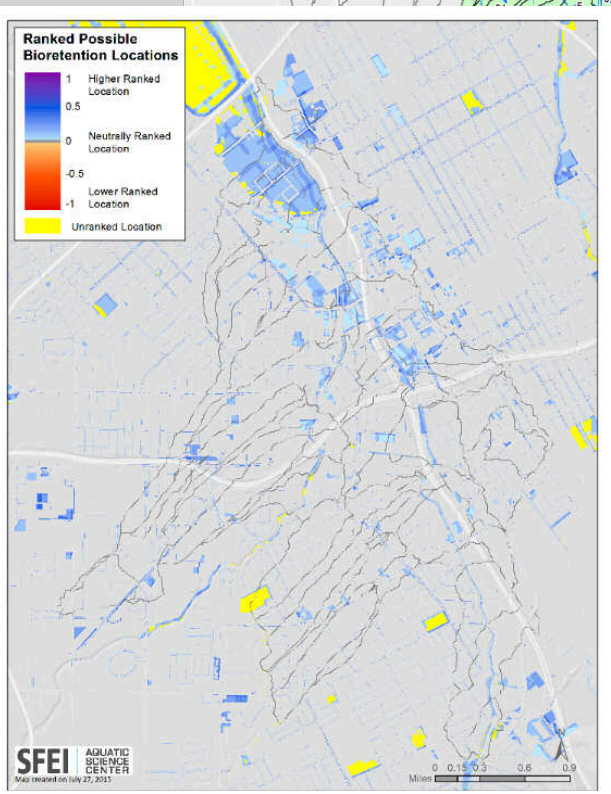
- 44% peak flow reduction
- 5.5 million gals of additional recharge



Step 5: Identify priority locations "Putting the pieces together"

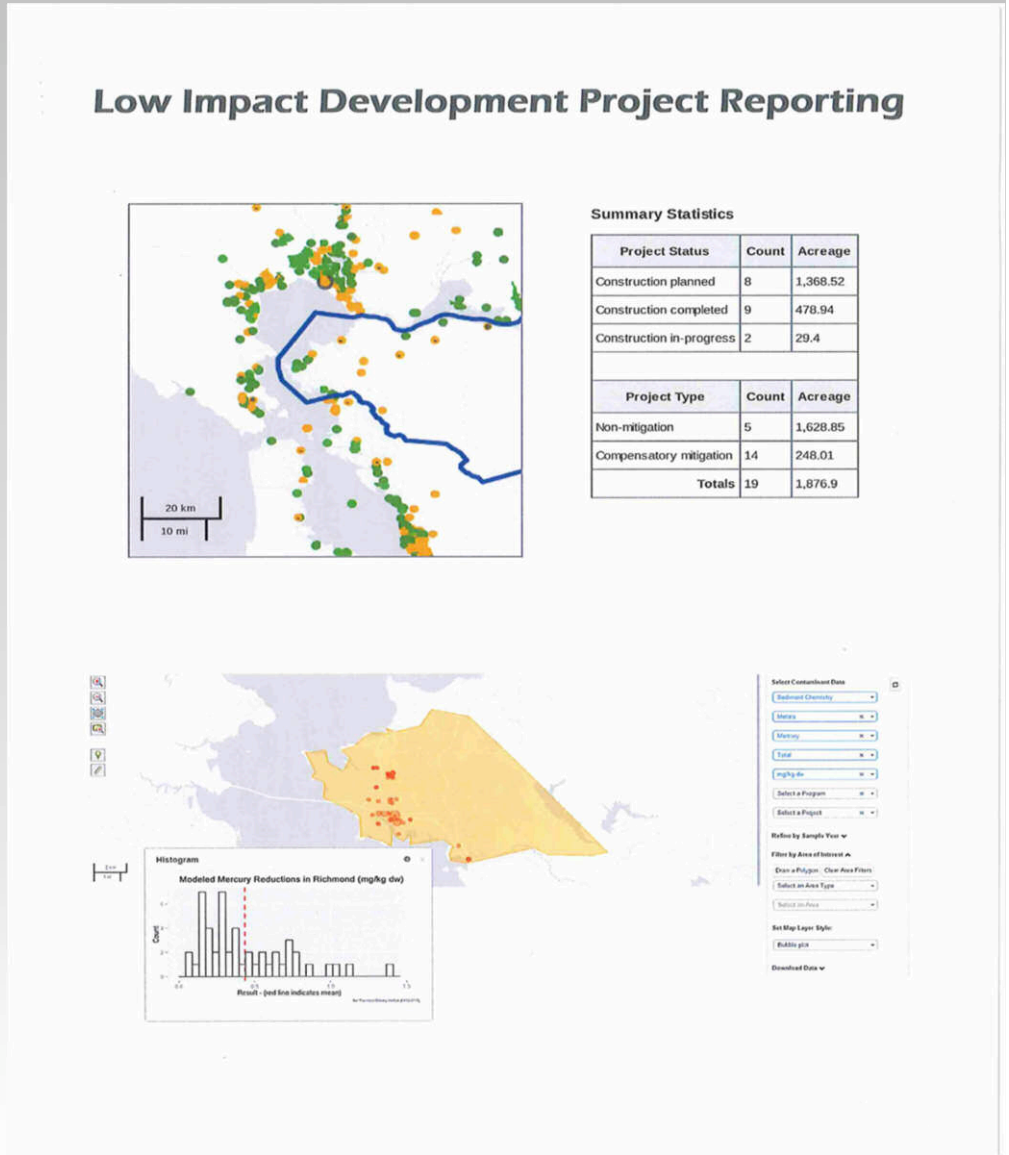
- Overlay optimization and site ranking output
- Combine with other information
  - Private partnerships or funding opportunities
  - Community needs
  - Existing flooding or pollution sources
  - Infrastructure age and condition
  - Capital improvement plans





LID tracker: Planned and Prospective Work

- LID tracker GIS Database piloted with one partner city
- Creation of data entry forms
- Interactive map for placement and display of LID locations
- Basic LID effectiveness reports



Toolkit Download & Documentation

http://greenplanit.sfei.org/

- ✓ Toolkit
- ✓ User manual
- ✓ Toolkit requirements
- ✓ Demonstration report

Questions?

Reasonable Assurance Analysis for Green Infrastructure Planning

Matthew Fabry, PE

San Mateo Countywide Water Pollution Prevention Program

September 23, 2015

SAN MATEO COUNTYWIDE
Water Pollution Prevention Program

Issues to Consider

- Integration and timing with Stormwater Resource Plans
- Scale
  - GI plans at local level
  - Load reduction at regional/county level
  - What scale to identify and prioritize projects
  - Tension between local plans, long-term "greening," and cost-effective load reduction
- Assumptions are critical
  - Results can have significant financial implications

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Water Pollution
Prevention Program

Issues to Consider

- Public vs Private
  - How do we consistently estimate future new/redevelopment
  - Need to model private for load reduction, but doesn't seem like we need to ID sites
- Data
  - Just using available data or figuring out what is really useful and generating it
- How do the outputs really help municipal planning?

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Green Streets

- Need agreement on treatment sizing
- Consider streets as units, intersection to intersection, split on centerline
- Catch basins as nodes, map tributary area within street units
- Identify required treatment per unit
- Optimize based on combinations of units
- Link to pavement maintenance programs
- Underdrain questions
- Tracking more meaningful if done by street segment

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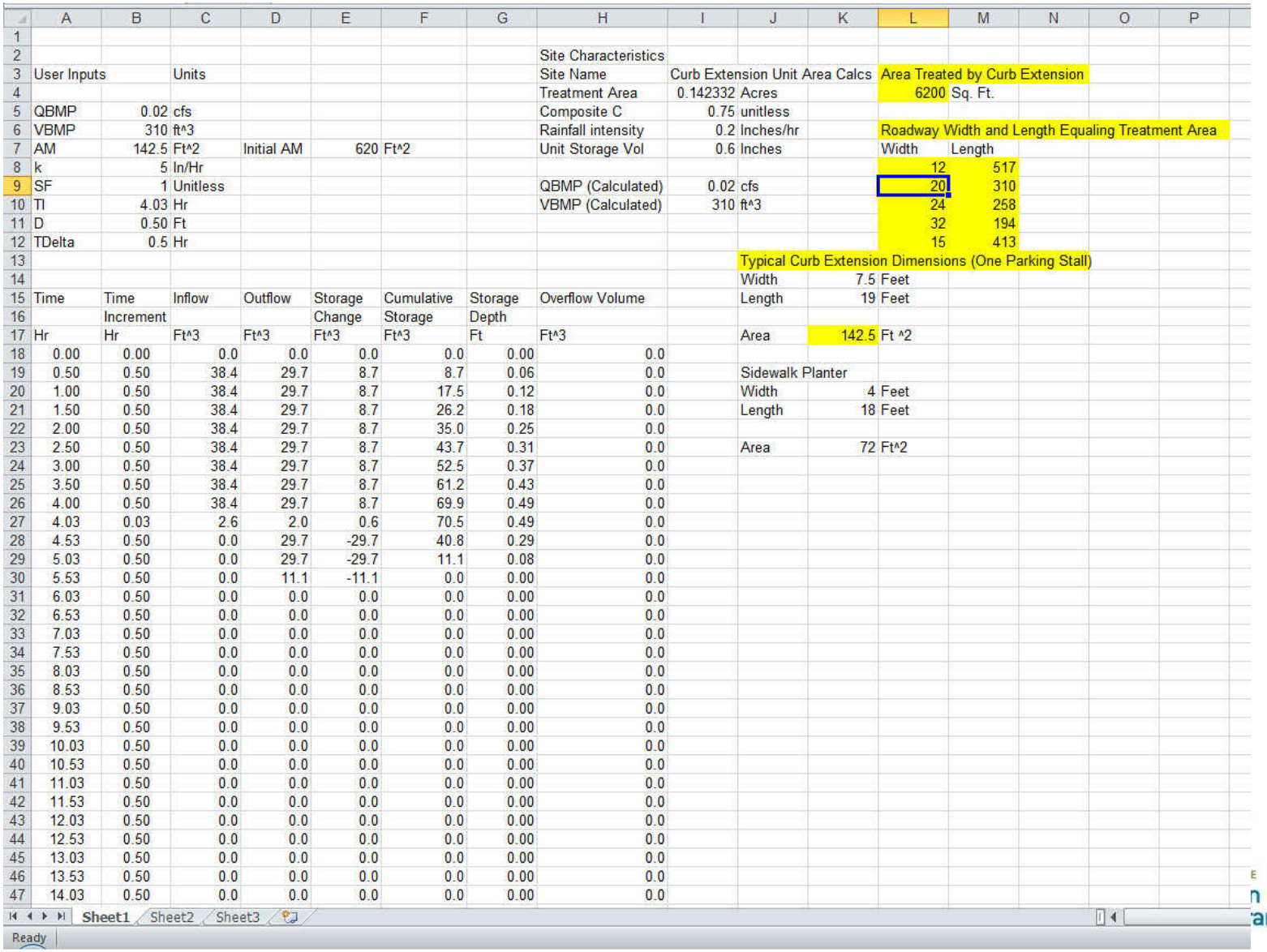
Prevention Program

Example

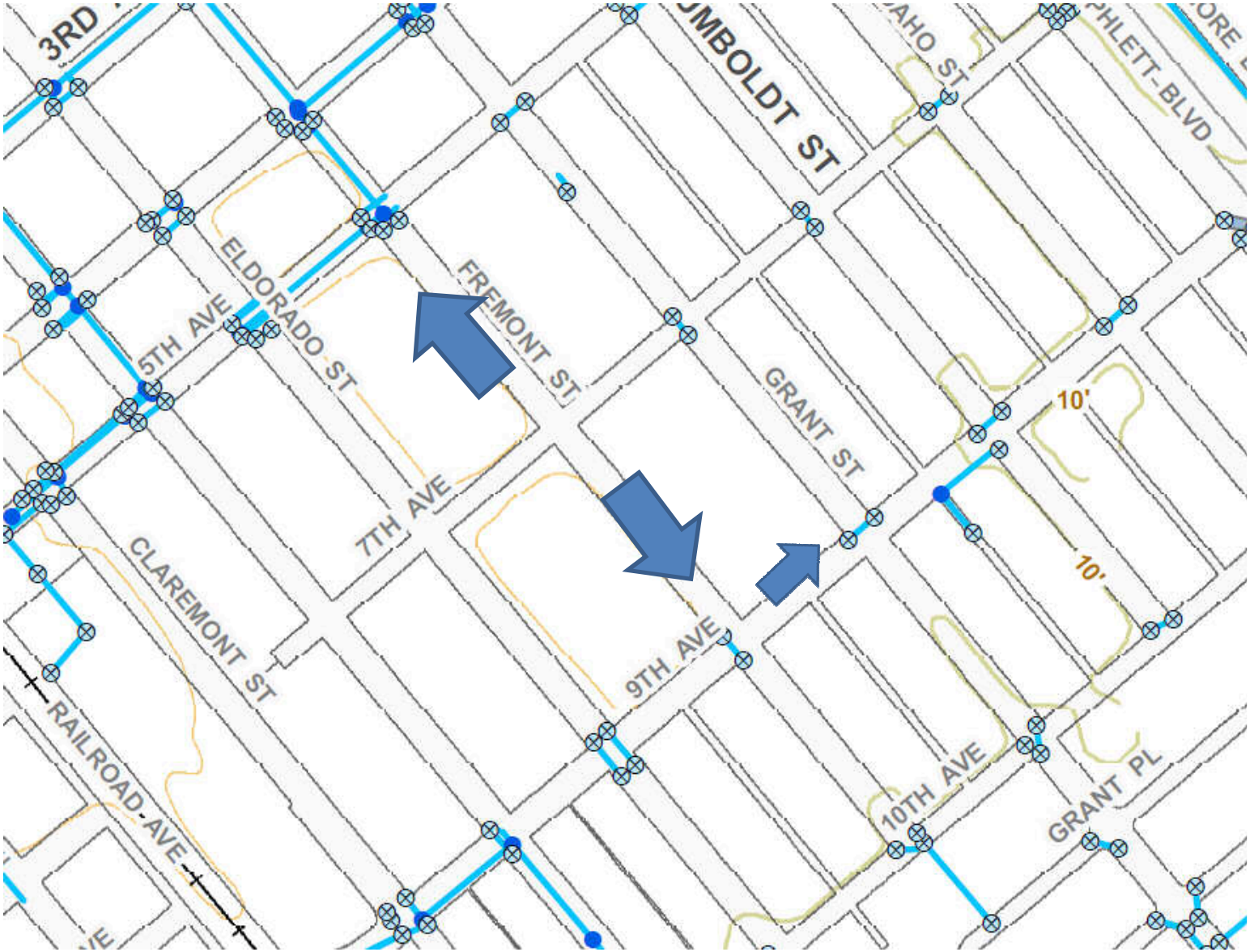


	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1																
2								Site Characteristics								
3	User Inputs		Units					Site Name	Curb Extension Unit Area Calcs	Area Treated by Curb Extension						
4								Treatment Area	0.142332	Acres		6200	Sq. Ft.			
5	QBMP	0.02	cfs					Composite C	0.75	unitless						
6	VBMP	310	ft^3					Rainfall intensity	0.2	Inches/hr		Roadway Width and Length Equaling Treatment Area				
7	AM	142.5	Ft^2	Initial AM	620	Ft^2		Unit Storage Vol	0.6	Inches		Width	Length			
8	k	5	In/Hr									12	517			
9	SF	1	Unitless					QBMP (Calculated)	0.02	cfs		20	310			
10	TI	4.03	Hr					VBMP (Calculated)	310	ft^3		24	258			
11	D	0.50	Ft									32	194			
12	TDelta	0.5	Hr									15	413			
13										Typical Curb Extension Dimensions (One Parking Stall)						
14										Width	7.5	Feet				
15	Time	Time	Inflow	Outflow	Storage	Cumulative	Storage	Overflow Volume		Length	19	Feet				
16		Increment			Change	Storage	Depth									
17	Hr	Hr	Ft^3	Ft^3	Ft^3	Ft^3	Ft	Ft^3		Area	142.5	Ft ^2				
18	0.00	0.00	0.0	0.0	0.0	0.0	0.00	0.0								
19	0.50	0.50	38.4	29.7	8.7	8.7	0.06	0.0		Sidewalk Planter						
20	1.00	0.50	38.4	29.7	8.7	17.5	0.12	0.0		Width	4	Feet				
21	1.50	0.50	38.4	29.7	8.7	26.2	0.18	0.0		Length	18	Feet				
22	2.00	0.50	38.4	29.7	8.7	35.0	0.25	0.0								
23	2.50	0.50	38.4	29.7	8.7	43.7	0.31	0.0		Area	72	Ft^2				
24	3.00	0.50	38.4	29.7	8.7	52.5	0.37	0.0								
25	3.50	0.50	38.4	29.7	8.7	61.2	0.43	0.0								
26	4.00	0.50	38.4	29.7	8.7	69.9	0.49	0.0								
27	4.03	0.03	2.6	2.0	0.6	70.5	0.49	0.0								
28	4.53	0.50	0.0	29.7	-29.7	40.8	0.29	0.0								
29	5.03	0.50	0.0	29.7	-29.7	11.1	0.08	0.0								
30	5.53	0.50	0.0	11.1	-11.1	0.0	0.00	0.0								
31	6.03	0.50	0.0	0.0	0.0	0.0	0.00	0.0								
32	6.53	0.50	0.0	0.0	0.0	0.0	0.00	0.0								
33	7.03	0.50	0.0	0.0	0.0	0.0	0.00	0.0								
34	7.53	0.50	0.0	0.0	0.0	0.0	0.00	0.0								
35	8.03	0.50	0.0	0.0	0.0	0.0	0.00	0.0								
36	8.53	0.50	0.0	0.0	0.0	0.0	0.00	0.0								
37	9.03	0.50	0.0	0.0	0.0	0.0	0.00	0.0								
38	9.53	0.50	0.0	0.0	0.0	0.0	0.00	0.0								
39	10.03	0.50	0.0	0.0	0.0	0.0	0.00	0.0								
40	10.53	0.50	0.0	0.0	0.0	0.0	0.00	0.0								
41	11.03	0.50	0.0	0.0	0.0	0.0	0.00	0.0								
42	11.53	0.50	0.0	0.0	0.0	0.0	0.00	0.0								
43	12.03	0.50	0.0	0.0	0.0	0.0	0.00	0.0								
44	12.53	0.50	0.0	0.0	0.0	0.0	0.00	0.0								
45	13.03	0.50	0.0	0.0	0.0	0.0	0.00	0.0								
46	13.53	0.50	0.0	0.0	0.0	0.0	0.00	0.0								
47	14.03	0.50	0.0	0.0	0.0	0.0	0.00	0.0								

Sheet1 Sheet2 Sheet3

Ready

Example


3RD
BOLDT ST
AHO ST
HLETT-BLVD
ELDORADO ST
5TH AVE
FREMONT ST
GRANT ST
7TH AVE
10'
10'
CLAREMONT ST
9TH AVE
RAILROAD AVE
10TH AVE
GRANT PL

Example

D	E	F	I	J	K	L	M	N
Street Name	Beg Location	End Location	Lar	Functional Class	Len	Wi	A	Curb Extensions Nee
09TH AVE - 2340	AMPHLETT W/S	HUMBOLDT E/S	2	C - Collector	662	32	21184	3.0
09TH AVE - 2340	HUMBOLDT W/S	DELAWARE E/S	2	C - Collector	1372	38	52136	7.4
09TH AVE - 2340	RAILROAD AVE	EL CAMINO REAL S	2	A - Arterial	1468	42	61656	8.8
09TH AVE - 2340	DELAWARE ST S W/S	B ST S W/S	2	A - Arterial	849	50	42450	6.1
FREMONT ST S - 0786	10TH N/S	9TH S/S	2	R - Residential/Local	560	24	13440	1.9
FREMONT ST S - 0786	CYPRESS	2ND	2	R - Residential/Local	760	26	19760	2.8
FREMONT ST S - 0786	2ND AVE N/S	2ND AVE S/S	2	C - Collector	160	27	4320	0.6
FREMONT ST S - 0786	5TH AVE	4TH AVE	2	R - Residential/Local	276	40	11040	1.6
FREMONT ST S - 0786	4TH AVE	3RD AVE	2	R - Residential/Local	303	40	12120	1.7
FREMONT ST S - 0786	3RD N/S	2ND S/S	2	R - Residential/Local	350	44	15400	2.2
FREMONT ST S - 0786	9TH N/S	5TH S/S	2	R - Residential/Local	1216	46	55936	8.0
GRANT ST S - 0858	10TH S/S	9TH	2	C - Collector	640	24	15360	2.2
GRANT ST S - 0858	16TH AVE S/S	10TH AVE S/S	2	C - Collector	2360	25	59000	8.4
GRANT ST S - 0858	2ND N/S	CYPRESS S/S	2	R - Residential/Local	735	30	22050	3.2
GRANT ST S - 0858	CONCAR	16TH	4	C - Collector	2041	34	69394	9.9
GRANT ST S - 0858	5TH	4TH S/S	2	C - Collector	295	39	11505	1.6
GRANT ST S - 0858	4TH N/S	3RD S/S	2	R - Residential/Local	330	39	12870	1.8
GRANT ST S - 0858	9TH	5TH	2	C - Collector	700	46	32200	4.6
GRANT ST S - 0858	19TH AVE N/S	CONCAR N/S	4	C - Collector	1055	65	68575	9.8
HUMBOLDT ST S - 1051	10TH AVE	09TH AVE N/S	2	A - Arterial	600	34	20400	2.9
HUMBOLDT ST S - 1051	09TH AVE N/S	05TH AVE N/S	2	A - Arterial	1259	36	45324	6.5
HUMBOLDT ST S - 1051	05TH AVE E N/S	04TH AVE E S/S	2	A - Arterial	239	39	9321	1.3
HUMBOLDT ST S - 1051	02ND AVE N/S	CYPRESS S/S	2	A - Arterial	732	39	28548	4.1

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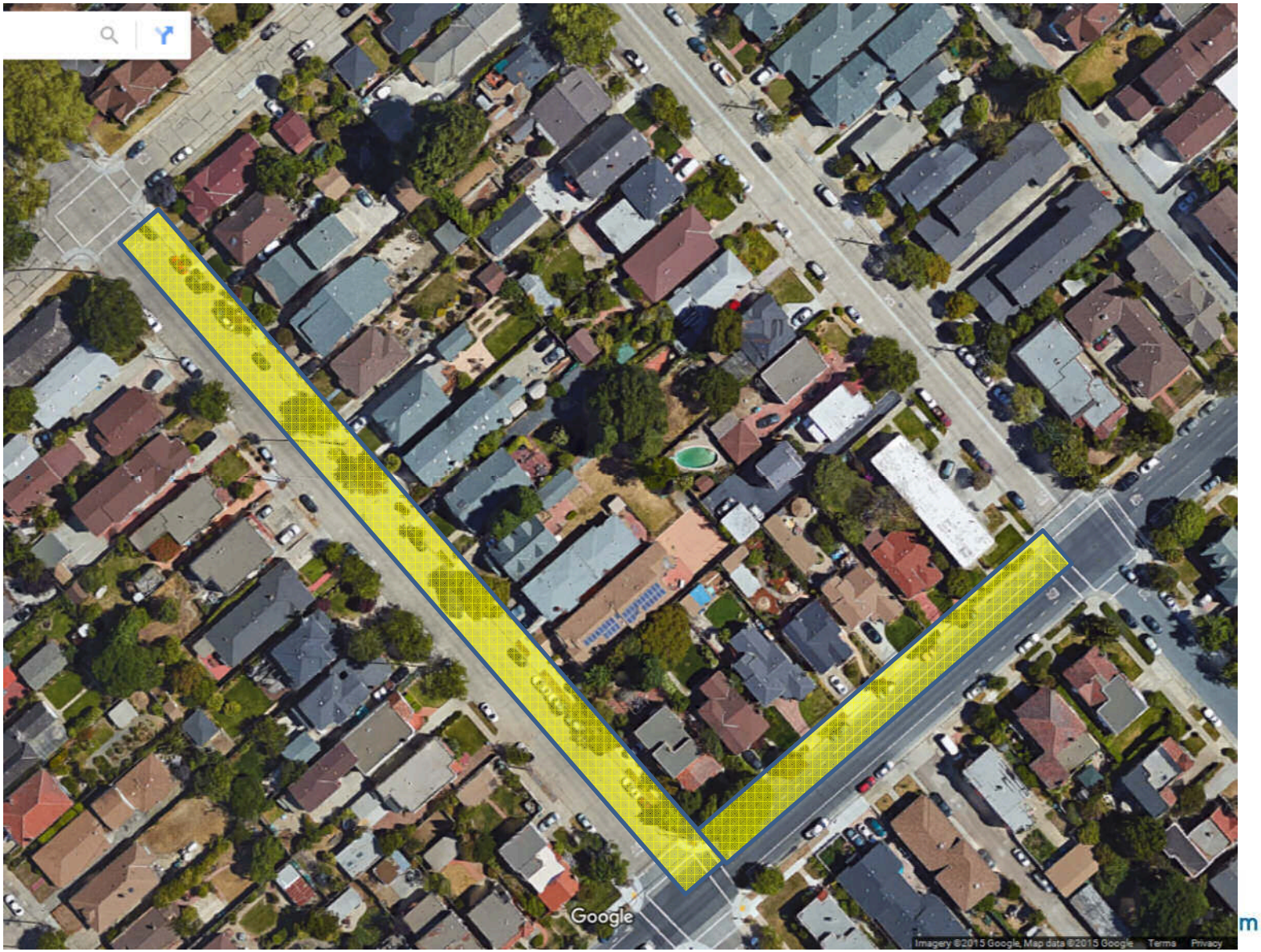
Example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Example

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Example

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Things to Consider

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